

CLAIMS

1. Miniature confocal optical head (4) for a confocal imaging system, in particular endoscopic, said head (4) comprising a point source for producing a light beam (13), characterized in that it also comprises:

- a ball lens (12) arranged at the end of the optical head (4), in order to cause said light beam (13) to converge into an excitation point (19) situated in a subsurface field under observation (14) of a sample (15), the numerical aperture of this lens and the dimensions of the point source being suitable to ensure the confocality of the assembly, and
- scanning means (10, 21, 22) for displacing the point source in rotation so that the excitation point (19) scans said field under observation.

2. Optical head according to claim 1, characterized in that, during scanning, the point source pivots independently of the ball lens.

3. Optical head according to claim 2, characterized in that, during scanning, the distance between the point source and the centre of the ball lens is kept constant so that the field under observation (14) is curved.

4. Optical head according to claim 1, characterized in that, during scanning, the point source is integral with the ball lens.

5. Optical head according to claim 4, characterized in that it also comprises means for introducing a liquid (23) between the external surface of the ball lens and the sample so as to ease the sliding of the ball lens over the sample.

6. Optical head according to claim 4, characterized in that it also comprises a fine rigid curved plate used as a window designed to allow the ball lens to slide over the sample.

7. Optical head according to any one of claims 4 to 6, characterized in that the scanning means (21, 22) act directly on the ball lens.

5 8. Optical head according to any one of the preceding claims, characterized in that the scanning means (10) act directly on the point source.

10 9. Optical head according to any one of the preceding claims, characterized in that it also comprises corrective optical means (11) integral with the point source and arranged between this point source and the ball lens (12) in order to correct residual aberrations of the ball lens.

15 10. Optical head according to any one of the preceding claims, characterized in that the scanning means comprise means for carrying out scanning along two rotational axes of the ball lens so as to obtain a two-dimensional image in real time.

20 11. Optical head according to claim 10, characterized in that the scanning along one of the rotational axes reaches a frequency of approximately 4 kHz.

12. Optical head according to any one of the preceding claims, characterized in that the scanning means comprise micro-motors.

25 13. Optical head according to any one of the preceding claims, characterized in that the scanning means comprise piezoelectric elements.

30 14. Optical head according to any one of the preceding claims, characterized in that the scanning means comprise MEMs-type micromechanical means.

15. Optical head according to any one of the preceding claims, characterized in that it comprises the terminal part of an optical fibre suitable

for conducting the light beam from an external source, the light beam emerging from the fibre constituting the point source.

5 16. Optical head according to claim 15, characterized in that the optical fibre is monomode with a core diameter and a numerical aperture allowing a spatial filtering of the return signal and therefore ensuring the confocality of the head.

10 17. Optical head according to any one of claims 1 to 14, characterized in that the point source is constituted by a VCSEL-type laser source, having a numerical aperture and a cavity outlet diameter compatible with a confocal system, and associated with a detector placed behind the VCSEL cavity.

15 18. Confocal imaging system comprising:
- a confocal optical head (4) with integrated scanning;
- a source (1, 2a, 2b) suitable for emitting a light beam;
- means of detection (5) of an emitted signal;
- means (9) for electronic and computer control and processing of the signal emitted suitable for reconstructing a confocal image of a field image,
20 characterized in that the optical head (4) is according to any one of the preceding claims.

25 19. System according to claim 18, characterized by an optical fibre (2a) connected to a laser source (1) and coupling means (3) for coupling said fibre (2a) with the optical fibre (2b) for transport to and from the optical head (4) and a fibre (2c) for transporting the emitted signal to the detection means.

30 20. System according to claim 18, characterized in that, the optical head comprising a VCSEL laser source and an integrated detector, the system comprises flexible connection means between the optical head and the signal processing means.